FIRST CLASS

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EG&G IDAHO DESIGNS SPECIAL TOOLS

TEAM TAKES TMI CORE SAMPLES

by Rita Scott, EG&G Idaho

A team of EG&G Idaho engineers took the first samples of the damaged Three Mile Island Unit 2 reactor core during entries made Sept. 9 and 12.

Dennis Fee, Jim Broughton, Dennis Owen and Jim Flaherty entered the TMI containment building and, working above the reactor, took three samples of particulate core material, about two cubic inches each, from three different depths in the center of the core.

Following the acquisition of three more core debris samples taken from another location in the core (for which the team will be joined by EG&G Idaho's Phil MacDonald), the six samples will be sent to off-site hot cell labs for analysis.

Analysis of this material is expected to provide information important to the defueling of the reactor. It will also give scientists basic technical data on the nature of core damage during a reactor accident.

The project was funded by the Department of Energy and conducted in cooperation with GPU Nuclear, the owner of the plant.

Last July a video camera, lowered into the reactor vessel, provided scientists with a quick look at core conditions. The video taken showed that the reactor's nuclear fuel had fragmented in the March 1979 accident, and as a result, a portion of the reactor core had collapsed into a bed of rubble. However, until samples were taken, investigators could only speculate on the exact depth, particle size and chemical makeup of the granular debris.

THE ROTATING SAMPLING tool for the TMI core grab sampling experiment has doors cut into each side of two tubes which are opened by rotating the inner tube. The tool is buried in the core debris bed, rotated, enclosing the firem (sand-like material) in the tool.

SUITABLY ATTIRED FOR a significant event, Jim Broughton, Dennis Fee and Dennis Owen prepare to enter the TMI Unit 2 reactor building to take samples of the damaged reactor core. Three samples were taken during this entry; during an early October entry, three more will be taken before the samples are shipped to national laboratories for examination.

The tools used during the entries were designed by Fee, a mechanical engineer with the Mechanical Hardware Engineering Branch, and built by EG&G Idaho. These tools consisted of a 46-foot long deployment boom and two types of sampling tools which attached to the end of the boom. One was designed like a clamshell, pointing down; the other sampler was a rotating tube device with doors cut into each side of two tubes. When the inner tube was rotated, the doors were opened, and the tool was buried in the debris. The tube was then rotated again, closing the doors and enclosing the material.

The team lowered sections of the boom, which weighed about 85 pounds, into the reactor vessel through an opening normally used for one of the reactor's control rod drive components.

Fee compares the experience to standing on top of a four-story chimney and trying to feel the bottom with a pole.

"We were feeling in the dark, because there was no way to see what we were doing. It felt a lot like scratching a stick along a dirt road," he says, noting that an acoustic monitoring device attached to the boom helped the team find the debris bed surface.

After each sample was taken, the sampler was pulled up into a shielded cask set over the reactor opening. In addition to holding the core debris, the casks provided radiation shielding for personnel handling the samples for shipping. The core samples are being shipped to various national laboratories, including the INEL, for examination and analysis.

Owen, senior project engineer for TMI programs, says he was surprised the sampling was so physically taxing because the team had practiced the sampling process more than 25 times.

"We were told to expect each entry to take two times longer inside the TMI-2 reactor building than during training, and it did," he states.

Also, Owen says the clothing was very cumbersome, and in spite of ice vests and air cooled suits, they were very warm.

"We wore two cotton suits and plastic coveralls, two sets of booties, rubber boots, skull cap, face respirator, two hoods, four sets of gloves and a radio."

In addition the team had dosimeters attached to ankles and thighs, their chests, wrists, fingers and skull, with flashlights taped to their arms.

Owen notes the boom and sampler, which weighed 80 pounds, worked well. So did all the people involved. He says the information from this analysis has implications not only for the defueling of the TMI Unit 2 reactor, but for all other possible reactor accidents and defueling.

"We will be looking at fission product content," he explains. "We want to know what fission products and how much of them remain in the fuel after such an accident and how much was driven out by high temperatures. The specific fission products that remain in the fuel will be measured. In the hot cell we will also determine the propensity of fission products to be released when the material is crushed or broken. We will also look at individual particles metallographically, to see how the fuel reacted with the fuel cladding during the accident."